

the Southwest on the 14th and moved northeastward over the upper Lake region, the center reaching the Lakes on the 15th. General warnings were displayed on both these dates.

The regular storm warning season terminated December 16, but advisory messages have been sent since that date to open ports on Lake Michigan in advance of threatening conditions.

The storm warning service rendered by the Weather Bureau during the season just passed has been very acceptable to all Lake marine interests, and practically no disasters through stress of weather overtook vessels that took advantage of the storm warnings and advisory messages. The Lake Marine News Bulletin on December 16 states as follows:

Captains give the Weather Bureau high praise for the excellence of its storm signals throughout the fall. Except the *Bannockburn*, nearly all the ships lost by foundering or stranding were well along in years, and some of them doubtless not well equipped to meet storms.

No exceptionally severe cold waves crossed over the district during the month, but the most marked condition was that which moved in from the Northwest on the 6th and 7th. Cold-wave warnings were issued for the entire district on the 6th. Warnings were again issued on the 23d and 24th and transportation companies notified.—*H. J. Cor, Professor of Meteorology.*

DENVER FORECAST DISTRICT.

On the morning of the 14th warning of a cold wave was sent to points in western Colorado and northern New Mexico; this warning was fully verified over nearly the entire area. The snowstorm of the 19th in eastern Wyoming and north-eastern Colorado, which was forecast, was the feature of the month. The attending high winds were not felt in central Colorado, but in southeastern Wyoming and the extreme northern and northeastern portions of Colorado the high velocities caused the wind to drift the snow badly, and on some railroad lines traffic was suspended three or four days. Fortunately for live stock interests, no very low temperatures attended the storm.—*F. H. Brandenburg, Forecast Official.*

SAN FRANCISCO FORECAST DISTRICT.

The month was on the whole rather free from severe storms. Less rain than usual fell, and with the exception of the storm in southern California of the 16-17th the damage was slight. The most interesting feature of the month was the daily receipt of a weather message from the Pacific Ocean, through the courtesy of the Commercial Cable Company, from the cable ship *Silverton*, engaged in laying cable to Honolulu.

Southeast storm warnings were displayed on the 3d from Point Reyes to Eureka, and incoming vessels reported high southeast winds off shore.

Southeast storm warnings were displayed from San Francisco to Eureka on the 8th, and advisory messages were sent to southern ports. In the vicinity of Point Reyes a maximum wind velocity of 54 miles an hour from the south occurred on the 9th.

Heavy rains occurred in central California on the 11th. Heavy frost occurred at many points on the 14th and 15th.

The first report from the cable ship *Silverton*, when about 90 miles off shore, was received on the 15th. An interesting fact is that the steamer then experienced strong southeast wind and rain, and twenty-four hours later, when nearly 300 miles southwest of San Francisco, the wind had changed to strong northwest with confused, heavy sea. The steamer appears to have run through the northern end of the disturbance which reached the coast of southern California on December 16. Unusually heavy rains occurred on the 17th from Point Conception southward. The *Silverton*, then about 500 miles southwest of San Francisco, reported terrific seas all

during the night of the 16th, with a heavy swell on the 17th and indications of better weather. The forecasts of rain for southern California for this period were verified. The winds recorded at Los Angeles and San Diego during this period do not indicate any marked disturbance in their vicinity, yet press dispatches would indicate that considerable damage was done near Terminal Island. The Pacific Mail steamer *Barracouta* reports that on the 17th, 20 miles off Point Conception, a severe storm was encountered, high waves sweeping clear over the vessel. At both observations on the 17th the wind at San Louis Obispo was reported as light from the west. The last decade of the month was marked by numerous frosts. Ample warnings were given and it is believed that but little injury resulted.—*A. G. McAdie, Professor.*

PORTLAND, OREG., FORECAST DISTRICT.

The month was wetter than usual in the western half of the North Pacific States, while east of the Cascades the precipitation averaged slightly below normal. Several storms of unusual severity passed over the district, for which warnings were ordered well in advance.—*E. A. Beals, Forecast Official.*

AREAS OF HIGH AND LOW PRESSURE.

Movements of centers of areas of high and low pressure.

Number.	First observed.			Last observed.			Path.		Average velocity.	
	Date.	Lat. N.	Long. W.	Date.	Lat. N.	Long. W.	Length.	Duration.	Daily.	Hourly.
High areas.										
I.....	2, a.m..	43	123	4, a.m..	40	97	1,625	2.0	812	38.8
II.....	2, p.m..	58	105	7, a.m..	45	67	1,000	1.5	667	27.8
III.....	4, p.m..	27	97	10, p.m..	32	65	2,150	2.5	860	35.8
IV.....	6, p.m..	54	114	13, a.m..	48	68	3,000	4.0	750	31.2
V.....	10, a.m..	58	109	16, a.m..	46	60	1,950	3.0	650	27.1
VI.....	12, a.m..	50	100	20, a.m..	32	65	2,400	4.0	600	25.0
VII.....	13, p.m..	50	120	24, p.m..	48	68	4,300	6.5	662	27.6
VIII.....	20, p.m..	54	114	29, a.m..	32	65	2,800	4.0	700	29.2
IX.....	24, p.m..	58	105	31, p.m..	40	75	3,000	4.5	667	27.8
	27, p.m..	41	114				3,250	4.0	812	38.8
Sums.....							25,475	36.0	7,180	299.1
Mean of 10 paths.....							2,548		718	29.9
Mean of 36.0 days.....									708	29.5
Low areas.										
I.....	30, p.m..	48	125	4, a.m..	45	64	3,800	3.5	1,086	45.2
II.....	3, a.m..	30	95	5, p.m..	46	60	2,225	2.5	890	37.1
III.....	3, p.m..	51	120	5, p.m..	45	93	1,675	2.0	838	34.9
IV.....	10, p.m..	43	123	14, a.m..	32	65	3,550	3.5	1,014	42.2
V.....	13, a.m..	33	115	17, p.m..	48	68	3,450	4.5	767	32.0
VI.....	18, p.m..	35	106	22, a.m..	48	68	2,325	3.5	664	27.7
VII.....	22, a.m..	52	121	28, a.m..	46	60	3,650	6.0	608	25.3
VIII.....	26, a.m..	51	120	29, p.m..	48	86	1,625	3.5	464	19.3
IX.....	27, a.m..	41	105	29, a.m..	32	88	1,500	2.0	750	31.2
Sums.....							23,800	31.0	7,081	294.9
Mean of 9 paths.....							2,633		787	32.8
Mean of 31.0 days.....									768	32.0

* November.

For graphic presentation of the movements of these highs and lows see Charts I and II.—*Geo. E. Hunt, Chief Clerk, Forecast Division.*

RIVERS AND FLOODS.

The Mississippi River at St. Paul, Minn., was closed by ice on the 3d, and at the close of the month it was blocked to within a short distance of Davenport, Iowa.

At the close of the corresponding month of 1901 the river was frozen nearly 200 miles farther south to Hannibal, Mo., and from the 19th to the 26th, inclusive, was practically blocked from Chester, Ill., to Cairo, Ill.

Heavy floating ice at Keokuk, Iowa, on the 8th terminated navigation for the season in that vicinity, while from St. Louis,